Amendments to the Specification

Please amend the paragraph before the title of the invention beginning on page 1, line 1, as follows:

~~DESCRIPTION~~

Please amend the sub-heading beginning on page 1, line 5, as follows:

~~TECHNICAL FIELD~~
BACKROUND OF THE INVENTION
1. Technical Field

Please amend the sub-heading beginning on page 1, line 11, as follows:

~~BACKGROUND ART~~
2. Description of the Related Art

Please amend the paragraph beginning on page 11, line 5, as follows:

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic perspective view showing an embodiment of the descaling nozzle of the present invention.

Fig. 2 is a schematic sectional view taken along line II-II of Fig. 1.

Fig. 3 is a schematic front view of the nozzle front end of Fig. 1.

Fig. 4 is a partial schematic perspective view showing another embodiment of this invention's nozzle front end.

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Fig. 5 is a schematic sectional view showing the front end of the nozzle of Fig. 4.

Fig. 6 is a schematic sectional view showing another embodiment of the tapered segment.

Fig. 7 is a schematic view showing another embodiment of the upstream end of the casing.

Fig. 8 is a schematic longitudinal sectional view showing the nozzle used in the Comparative Examples.

Fig. 9 is a graph showing the collisional force distribution in the width direction of the discharge flow of Example 3.

Fig. 10 is a graph showing the collisional force distribution in the width direction of the discharge flow of Example 2.

Fig. 11 is a graph showing the collisional force distribution in the width direction of the discharge flow of Example 1.

Fig. 12 is a graph showing the collisional force distribution in the width direction of the discharge flow of Comparative Example 3.

Fig. 13 is a graph showing the collisional force distribution in the width direction of the discharge flow of Comparative Example 2.

Fig. 14 is a graph showing the collisional force distribution in the width direction of the discharge flow of Comparative Example 1.

Please amend the paragraph beginning on page 12, line 24, as follows:

As shown in Figs. 1 through 3, the descaling nozzle 1 comprises a cylindrical casing 2 into which water can flow from the upstream side and which has a cylindrical flow path (hollow cylindrical passage or nozzle orifice), a cylindrical nozzle case 11 in which the casing can be fitted, and a cemented carbide nozzle tip 12 which is fitted onto the front end of the nozzle case and is for discharging a discharge flow from its front end via a flow path (or nozzle orifice). The nozzle orifice or the flow path is formed in

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the axial direction of the central axes of these members. In the present embodiment, the cylindrical casing 2 comprises a first casing 2a which can be screwed into the nozzle case 11, and a second casing 2b which can be fitted onto this casing 2a, and the first and second casings 2a and 2b are united with each other by screwing, or ~~others~~ the like.

Please amend the paragraph beginning on page 13, line 13, as follows:

At the circumferential face and end face (flat face) of the upstream end of the second casing 2b, a plurality of slits (or inflow entrances) 3 are formed at predetermined intervals in the circumferential direction to form a filter, and the slits extend in the axial direction and are for allowing the inflow of water ~~with~~ while inhibiting the inflow of foreign matter. Further, in order to guide water flowing from the filter to the nozzle orifice, a rectifying unit (or a rectifier or a stabilizer) 4 is disposed or installed in the flow path inside the second casing 2b, and this rectifying unit 4 is provided with a plurality of rectifying plates (rectifying blades) 5 extending in the radial direction from a core body, and sharp conical sections (conical parts that are narrowed to a point at the upstream side and the downstream side 6, respectively) 6a and 6b, the conical sections being formed coaxially at the upstream side and downstream side of the core body and having their sharp end portions ~~directing~~ directed in to the upstream and downstream directions, respectively. The second casing 2b, ~~forming~~ which forms a filter and ~~being~~ is equipped with a rectifying unit, may be called a filter unit or a rectifying casing. The rectifying plates 5 of the rectifying unit 4 contact ~~with~~ the inner wall of the casing and the rectifying unit 4 is restricted in movement towards the downstream side by a fixing means (engagement, fitting, welding, adhering, etc.).

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Please amend the paragraph beginning on page 14, line 12, as follows:

The flow path of the cylindrical casing 2 comprises a cylindrical flow path P1 extending from the upstream end (inflow entrance) of the second casing 2b to the downstream end of the rectifying unit 4 and being of substantially the same inner diameter, an inclined flow path (annular inclined flow path) P2 extending in the downstream direction from the downstream end of the above-described rectifying unit 4 to a middle part of the first casing 2a and narrowing in ~~the~~ a tapered form at a gradual or progressive incline, and a cylindrical flow path P3 extending in the downstream direction from the downstream end of the inclined flow path with the inner diameter being substantially the same. In the present embodiment, the taper angle of the inclined wall (tapered segment) forming the inclined flow path (annular inclined flow path) P2 is formed to be, for example, about 5 to 10°.

Please amend the paragraph beginning on page 15, line 1, as follows:

Inside the nozzle case 11, a cemented carbide nozzle tip 12 and a bushing (or annular side wall) 17 having a flow path of substantially the same inner diameter as that of the downstream end of the first casing 2a are successively fitted from the front end towards the upstream direction, and the nozzle tip 12 is prevented from falling through in the direction of the front end by an engagement step 13. At the front end face of the nozzle tip 12, a curved groove 14 of a U-letter configuration in cross section is formed in the radial direction and a discharge orifice 15 having an elliptical shape is opened at the curved concave surface of the curved groove 14. The bottom surface of the curved groove 14, ~~having~~ which has a U-letter configuration in cross section, may be a curved bottom surface with the discharge orifice 15 at the lowermost area and being raised at both ends towards the direction to which the bottom surface extends (or the radial direction).

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Please amend the paragraph beginning on page 15, line 18, as follows:

The nozzle orifice extending in the axial direction of the nozzle 1 comprises the discharge orifice (or spray opening) 15 opening in an elliptical shape (or configuration) at the above-mentioned curved concave surface 14, a conical flow path P5 formed in the nozzle tip 12 and formed by a tapered segment (or conical inclined wall) 16 that extends ~~with~~ while rectilinearly enlarging in diameter towards the upstream direction along the axial line from the discharge orifice 15, and a cylindrical flow path P4 formed by the bushing 17 and being continuous in the upstream direction with the inner diameter being substantially the same along the axial direction from the upstream end of the tapered segment 16. That is, the flow path (nozzle orifice) of the nozzle 1 comprises the discharge orifice 15 opening in an elliptical shape at the curved concave surface 14 at the front end, the tapered flow path (or conical flow path) P5 extending towards the upstream side from the discharge orifice ~~with~~ while spreading or expanding at a predetermined taper angle θ due to the tapered side wall (conical side wall) 16, and large-diameter cylindrical flow paths (flow paths extending from the upstream end of the tapered flow path P5 to the upstream end of the rectifying unit 4) P4 to P1, and the large-diameter cylindrical flow paths extend from the upstream end of the tapered flow path with the inner diameter being substantially the same due to the annular side wall of the bushing 17. The flow paths that extend from the upstream end of the tapered segment 16 with the inner diameter being substantially the same (in the present embodiment, the cylindrical flow paths P3 and P4 extending from the upstream end of the large-diameter segment to the downstream end of the gradually inclined flow path P2) may be arranged as a large-diameter segment 18.

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Please amend the paragraph beginning on page 17, line 22, as follows:

When such a nozzle 1 is used, since the tapered segment 16 inclines rectilinearly from the large-diameter segment 18 of the nozzle orifice to the discharge orifice 15, a sharp collisional force distribution can be realized and scale can be removed efficiently with a low pressure and a low flow rate, even with a compact arrangement. Further, since descaling can be conducted with a low pressure and a low flow rate, the descaling efficiency can be improved ~~with~~ while inhibiting the cooling of a steel plate. Furthermore, by bringing the nozzle 1 close to a steel plate, the collisional force can be enhanced further to improve the descaling performance. The above-described nozzle 1 is thus useful as a descaling nozzle (or flat descaling nozzle) for discharging water to remove scale from the surface of a steel plate produced by hot rolling, or ~~others~~ the like.

Please amend the paragraph beginning on page 18, line 10, as follows:

In the nozzle of the present invention, as long as the nozzle has a nozzle orifice extending from a large-diameter segment to a discharge orifice via a predetermined tapered segment and a flat spray nozzle can be arranged, the shape of the nozzle orifice including the discharge orifice, is not restricted in particular and various nozzle orifices may be used. For example, the concave surface at the front end of the nozzle is not limited to the above-described groove having the U-letter configuration in cross section (curved cross-section surface) and may be a curved concave surface (a curved surface wherein the opening or front side is broad or wide and the upstream or bottom side is narrowed, for example, a curved concave surface such as a spherical concave surface, an elliptical concave surface, a bowl-like concave surface, or a bell-like concave surface). Furthermore, the concave surface at the nozzle front end may be formed by a concave section (or site) having a side wall which inclines in a curving or in

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a rectilinear manner.

Please amend the paragraph beginning on page 19, line 2, as follows:

Fig. 4 is partial schematic perspective view showing another embodiment of the nozzle front end of the present invention and Fig. 5 shows a schematic sectional view of the nozzle front end of Fig. 4. In this embodiment, an elliptical concave area 24 (or annular concave area) is formed at the front end of a cement carbide nozzle tip 22, which is fitted or affixed onto a nozzle case 21, and this concave area 24 comprises an inclined side wall 24a which inclines (or narrows) inwardly, in rectilinear or curving manner, in the radial direction towards the upstream side from the nozzle front end, and a circumferential wall 24b extending in the axial direction from the upstream end of the inclined side wall. At the central site or part of such a concave area 24 is opened an elliptical discharge orifice 25 having the same axial line as the major axis of the above-described elliptical concave area 24. As in the above-described embodiment, in the upstream direction from this discharge orifice (or the upstream end of the above-mentioned circumferential wall) 25 are formed, a tapered flow path (or conical flow path) P5 spreading or extending at a predetermined taper angle θ due to a tapered annular side wall (or tapered side wall) 26, and a flow path (large-diameter flow path or large-diameter segment) P4 (or P4 to P1) extending with substantially the same inner diameter due to a bushing or an annular side wall 27.

Please amend the paragraph beginning on page 19, line 27, as follows:

~~Even by~~ With such a nozzle, since water can be sprayed from the discharge orifice via the large-diameter segment and tapered segment, the descaling efficiency can be improved even at a low pressure and/or a low flow rate. Furthermore, since a predetermined thickness can be secured along the entire circumference of the

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discharge orifice by means of the circumferential wall and an angle of the tapered segment (or tapered side wall) against the inclined side wall can be increased to make the wall thicken, the wear resistance of the nozzle orifice including the discharge orifice can be improved. Furthermore, since the inclined side wall is formed across the entire circumference of the discharge orifice and the discharge orifice is positioned at a deep section or area, even if the discharge flow from the nozzle splashes back from a steel plate, etc., the anxiety of collision of the bounced water against the discharge orifice and its peripheral area can be lessened. The durability of the nozzle can thus be improved.

Please amend the paragraph beginning on page 22, line 23, as follows:

The above-mentioned tapered segment may be a multi-step (or multistage) tapered segment comprising a plurality of tapered segments each having a different angle (for example, not less than three tapered segments). The plurality of tapered segments may be formed so that their taper angles increase successively or decrease successively towards the upstream direction. Though the plurality of tapered segments may be formed so as to be separated in the upstream direction from the tapered segment of the front end, the plurality of tapered segments are usually formed so as to be adjacent or continuous with the tapered segment at the front end. Furthermore, as long as a tapered segment that increases continuously in inner diameter towards the upstream side of the axial direction from the discharge orifice is formed, a tapered surface may be formed by a spindle-shaped curved surface (curved tapered surface).

Please amend the paragraph beginning on page 27, line 11, as follows:

The inflow entrances constituting the above-described filter ~~is~~ are not limited to axially extending slits and may be formed as slits extending in the circumferential

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direction, as slits extending in random directions, or as a plurality of orifices or holes (or openings). Further, the inflow entrances are not restricted to being provided at both the circumferential face and end face but may be formed on the circumferential face of the cylindrical casing or on the upstream end face. Furthermore, instead of forming the inflow entrances constituting the filter on the cylindrical casing, a rectifying unit may be disposed inside an upstream end of the cylindrical casing with the opening of the upstream end of the casing.

Please amend the paragraph beginning on page 27, line 24, as follows:

As is clear from the above, this description also discloses a nozzle tip, which is for forming a nozzle orifice continuing with a cylindrical large-diameter segment (large-diameter flow path) having almost the same ~~in~~ inner diameter. The nozzle tip comprises a discharge orifice opening at a concave surface or concave area of a front end, and a tapered segment (or conical wall segment) formed to have a predetermined taper angle θ towards the upstream direction from the discharge orifice. Such a nozzle tip may be (1) a nozzle tip having a conical flow path formed by a tapered segment extending with a taper angle θ of 30 to 80° in the upstream direction ~~from~~ of the discharge orifice to the upstream end, or (2) a nozzle tip having a flow path extending in the upstream direction from the discharge orifice with the inner diameter being substantially the same and having the ratio (L/D_1) of the length L relative to the inner diameter D_1 being less than 1 ($L/D_1 < 1$), and a conical flow path formed by a tapered segment extending with a taper angle θ of 30 to 80° in the upstream direction from the flow path. The nozzle tip may also have (3) a conical flow path formed by a tapered segment extending with a taper angle θ of 30 to 80° in the upstream direction from the discharge orifice, and a flow path extending in the upstream direction from the conical flow path with the inner diameter being substantially the same. In the nozzle tip (3), the flow path extending towards the upstream direction from the conical flow path may be

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such that the ratio (L/D_1) of the flow path length L relative to the inner diameter D_1 is less than 1 ($L/D_1 < 1$) or is not less than 1.

Please amend the paragraph beginning on page 28, line 27, as follows:

The nozzle tip may comprise a concave surface or concave area formed at a front end, a discharge orifice formed at a central area of the concave surface or concave area, and a conical flow path extending with a predetermined taper angle θ in the upstream direction from the discharge orifice. Further, the concave area formed at the end of the nozzle tip may comprise an inclined side wall which inclines inwardly in the radial direction towards the upstream direction from the nozzle front end.

Please amend the sub-heading beginning on page 33, line 15, as follows:

~~INDUSTRIAL APPLICABILITY~~

Amendment to the Claims

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